**0817AII Common Core State Standards**

1 The function $f(x) = \dfrac{x-3}{x^2 + 2x - 8}$ is undefined when

x equals
1) 2 or − 4
2) 4 or − 2
3) 3, only
4) 2, only

2 Which expression is equivalent to $(3k - 2i)^2$, where
i is the imaginary unit?
1) $9k^2 - 4$
2) $9k^2 + 4$
3) $9k^2 - 12ki - 4$
4) $9k^2 - 12ki + 4$

3 The roots of the equation $x^2 + 2x + 5 = 0$ are
1) −3 and 1
2) −1, only
3) $-1 + 2i$ and $-1 - 2i$
4) $-1 + 4i$ and $-1 - 4i$

4 The solution set for the equation
$\sqrt{x + 14} - \sqrt{2x + 5} = 1$ is
1) {−6}
2) {2}
3) {18}
4) {2,22}

5 As x increases from 0 to $\dfrac{\pi}{2}$, the graph of the
equation $y = 2\tan x$ will
1) increase from 0 to 2
2) decrease from 0 to −2
3) increase without limit
4) decrease without limit

6 Which equation represents a parabola with the
focus at $(0, -1)$ and the directrix of $y = 1$?
1) $x^2 = -8y$
2) $x^2 = -4y$
3) $x^2 = 8y$
4) $x^2 = 4y$

7 Which diagram represents an angle, α, measuring $\dfrac{13\pi}{20}$ radians drawn in standard position, and its reference angle, θ?

1)

2)

3)

4)
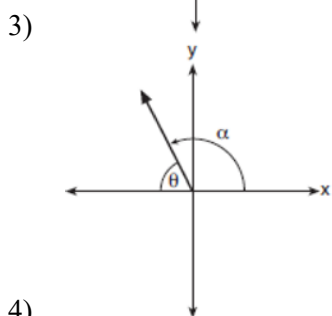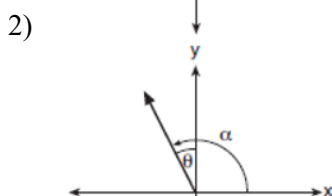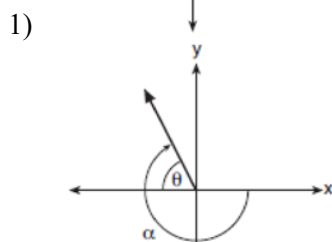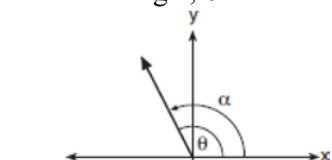
8 What are the zeros of $P(m) = (m^2 - 4)(m^2 + 1)$?
1) 2 and -2, only
2) $2, -2$, and -4
3) $-4, i$, and $-i$
4) $2, -2, i$, and $-i$

9 The value of a new car depreciates over time. Greg purchased a new car in June 2011. The value, V, of his car after t years can be modeled by the equation $\log_{0.8}\left(\dfrac{V}{17000}\right) = t$. What is the average decreasing rate of change per year of the value of the car from June 2012 to June 2014, to the *nearest ten dollars per year*?
1) 1960
2) 2180
3) 2450
4) 2770

10 lridium-192 is an isotope of iridium and has a half-life of 73.83 days. If a laboratory experiment begins with 100 grams of Iridium-192, the number of grams, A, of Iridium-192 present after t days would be $A = 100\left(\dfrac{1}{2}\right)^{\frac{t}{73.83}}$. Which equation approximates the amount of Iridium-192 present after t days?
1) $A = 100\left(\dfrac{73.83}{2}\right)^t$
2) $A = 100\left(\dfrac{1}{147.66}\right)^t$
3) $A = 100(0.990656)^t$
4) $A = 100(0.116381)^t$

11 The distribution of the diameters of ball bearings made under a given manufacturing process is normally distributed with a mean of 4 cm and a standard deviation of 0.2 cm. What proportion of the ball bearings will have a diameter less than 3.7 cm?
1) 0.0668
2) 0.4332
3) 0.8664
4) 0.9500

12 A polynomial equation of degree three, $p(x)$, is used to model the volume of a rectangular box. The graph of $p(x)$ has x intercepts at -2, 10, and 14. Which statements regarding $p(x)$ could be true?

A. The equation of $p(x) = (x - 2)(x + 10)(x + 14)$.
B. The equation of $p(x) = -(x + 2)(x - 10)(x - 14)$.
C. The maximum volume occurs when $x = 10$.
D. The maximum volume of the box is approximately 56.

1) *A* and *C*
2) *A* and *D*
3) *B* and *C*
4) *B* and *D*

13 Which expression is equivalent to $\dfrac{4x^3 + 9x - 5}{2x - 1}$, where $x \neq \dfrac{1}{2}$?

1) $2x^2 + x + 5$
2) $2x^2 + \dfrac{11}{2} + \dfrac{1}{2(2x - 1)}$
3) $2x^2 - x + 5$
4) $2x^2 - x + 4 + \dfrac{1}{2x - 1}$

14 The inverse of the function $f(x) = \dfrac{x + 1}{x - 2}$ is

1) $f^{-1}(x) = \dfrac{x + 1}{x + 2}$
2) $f^{-1}(x) = \dfrac{2x + 1}{x - 1}$
3) $f^{-1}(x) = \dfrac{x + 1}{x - 2}$
4) $f^{-1}(x) = \dfrac{x - 1}{x + 1}$

15 Which expression has been rewritten correctly to form a true statement?

1) $(x + 2)^2 + 2(x + 2) - 8 = (x + 6)x$
2) $x^4 + 4x^2 + 9x^2y^2 - 36y^2 = (x + 3y)^2(x - 2)^2$
3) $x^3 + 3x^2 - 4xy^2 - 12y^2 = (x - 2y)(x + 3)^2$
4) $(x^2 - 4)^2 - 5(x^2 - 4) - 6 = (x^2 - 7)(x^2 - 6)$

16 A study conducted in 2004 in New York City found that 212 out of 1334 participants had hypertension. Kim ran a simulation of 100 studies based on these data. The output of the simulation is shown in the diagram below.

Proportion of Successes
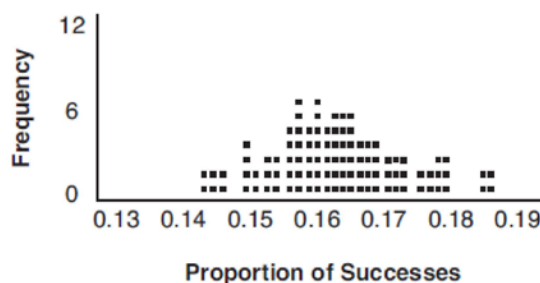
At a 95% confidence level, the proportion of New York City residents with hypertension and the margin of error are closest to

1) proportion $\approx .16$; margin of error $\approx .01$
2) proportion $\approx .16$; margin of error $\approx .02$
3) proportion $\approx .01$; margin of error $\approx .16$
4) proportion $\approx .02$; margin of error $\approx .16$

3

17 Which scenario is best described as an observational study?
  1) For a class project, students in Health class ask every tenth student entering the school if they eat breakfast in the morning.
  2) A social researcher wants to learn whether or not there is a link between attendance and grades. She gathers data from 15 school districts.
  3) A researcher wants to learn whether or not there is a link between children's daily amount of physical activity and their overall energy level. During lunch at the local high school, she distributed a short questionnaire to students in the cafeteria.
  4) Sixty seniors taking a course in Advanced Algebra Concepts are randomly divided into two classes. One class uses a graphing calculator all the time, and the other class never uses graphing calculators. A guidance counselor wants to determine whether there is a link between graphing calculator use and students' final exam grades.

18 Which sinusoid has the greatest amplitude?
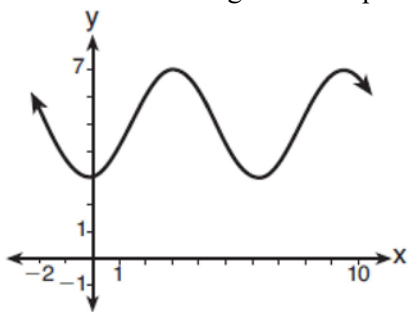
  1)
  2) $y = 3\sin(\theta - 3) + 5$
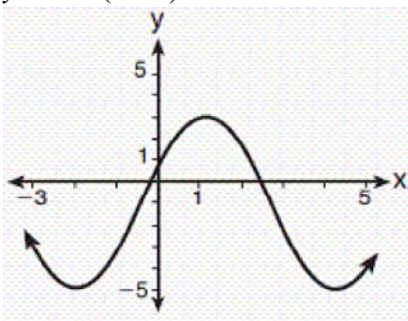
  3)
  4) $y = -5\sin(\theta - 1) - 3$

19 Consider the system shown below.
$$2x - y = 4$$
$$(x + 3)^2 + y^2 = 8$$
The two solutions of the system can be described as
  1) both imaginary
  2) both irrational
  3) both rational
  4) one rational and one irrational

20 Which binomial is *not* a factor of the expression $x^3 - 11x^2 + 16x + 84$?
  1) $x + 2$
  2) $x + 4$
  3) $x - 6$
  4) $x - 7$

21 A ball is dropped from a height of 32 feet. It bounces and rebounds 80% of the height from which it was falling. What is the total downward distance, in feet, the ball traveled up to the 12th bounce?
  1) 29
  2) 58
  3) 120
  4) 149

22 A public opinion poll was conducted on behalf of Mayor Ortega's reelection campaign shortly before the election. 264 out of 550 likely voters said they would vote for Mayor Ortega; the rest said they would vote for his opponent. Which statement is *least* appropriate to make, according to the results of the poll?
  1) There is a 48% chance that Mayor Ortega will win the election.
  2) The point estimate ($\hat{p}$) of voters who will vote for Mayor Ortega is 48%.
  3) It is most likely that between 44% and 52% of voters will vote for Mayor Ortega.
  4) Due to the margin of error, an inference cannot be made regarding whether Mayor Ortega or his opponent is most likely to win the election.

23 What does $\left(\dfrac{-54x^9}{y^4}\right)^{\frac{2}{3}}$ equal?

1) $\dfrac{9ix^6\sqrt[3]{4}}{y\sqrt[3]{y^2}}$

2) $\dfrac{9ix^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$

3) $\dfrac{9x^6\sqrt[3]{4}}{y\sqrt[3]{y}}$

4) $\dfrac{9x^6\sqrt[3]{4}}{y^2\sqrt[3]{y^2}}$

24 The Rickerts decided to set up an account for their daughter to pay for her college education. The day their daughter was born, they deposited $1000 in an account that pays 1.8% compounded annually. Beginning with her first birthday, they deposit an additional $750 into the account on each of her birthdays. Which expression correctly represents the amount of money in the account n years after their daughter was born?

1) $a_n = 1000(1.018)^n + 750$

2) $a_n = 1000(1.018)^n + 750n$

3) $a_0 = 1000$

   $a_n = a_{n-1}(1.018) + 750$

4) $a_0 = 1000$

   $a_n = a_{n-1}(1.018) + 750n$

25 Explain how $(-8)^{\frac{4}{3}}$ can be evaluated using properties of rational exponents to result in an integer answer.

26 A study was designed to test the effectiveness of a new drug. Half of the volunteers received the drug. The other half received a sugar pill. The probability of a volunteer receiving the drug and getting well was 40%. What is the probability of a volunteer getting well, given that the volunteer received the drug?

27 Verify the following Pythagorean identity for all values of x and y:
$$(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$$

28 Mrs. Jones had hundreds of jelly beans in a bag that contained equal numbers of six different flavors. Her student randomly selected four jelly beans and they were all black licorice. Her student complained and said "What are the odds I got all of that kind?" Mrs. Jones replied, "simulate rolling a die 250 times and tell me if four black licorice jelly beans is unusual." Explain how this simulation could be used to solve the problem.

29 While experimenting with her calculator, Candy creates the sequence 4, 9, 19, 39, 79, ... Write a recursive formula for Candy's sequence. Determine the eighth term in Candy's sequence.

30 In New York State, the minimum wage has grown exponentially. In 1966, the minimum wage was $1.25 an hour and in 2015, it was $8.75. Algebraically determine the rate of growth to the *nearest percent*.

31 Algebraically determine whether the function $j(x) = x^4 - 3x^2 - 4$ is odd, even, or neither.

32 On the axes below, sketch a possible function
$p(x) = (x - a)(x - b)(x + c)$, where a, b, and c are
positive, $a > b$, and $p(x)$ has a positive y-intercept
of d. Label all intercepts.
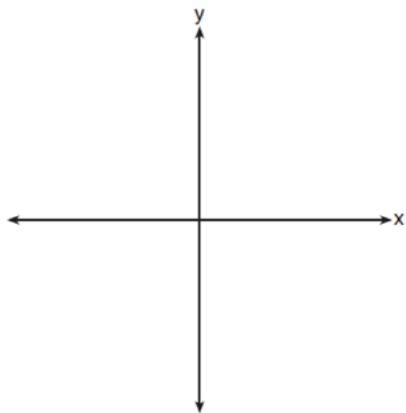
33 Solve for all values of p: $\dfrac{3p}{p - 5} - \dfrac{2}{p + 3} = \dfrac{p}{p + 3}$

34 Simon lost his library card and has an overdue
library book. When the book was 5 days late, he
owed $2.25 to replace his library card and pay the
fine for the overdue book. When the book was 21
days late, he owed $6.25 to replace his library card
and pay the fine for the overdue book. Suppose the
total amount Simon owes when the book is n days
late can be determined by an arithmetic sequence.
Determine a formula for a_n, the nth term of this
sequence. Use the formula to determine the
amount of money, in dollars, Simon needs to pay
when the book is 60 days late.

35 a) On the axes below, sketch *at least one* cycle of a
sine curve with an amplitude of 2, a midline at
$y = -\dfrac{3}{2}$, and a period of 2π.
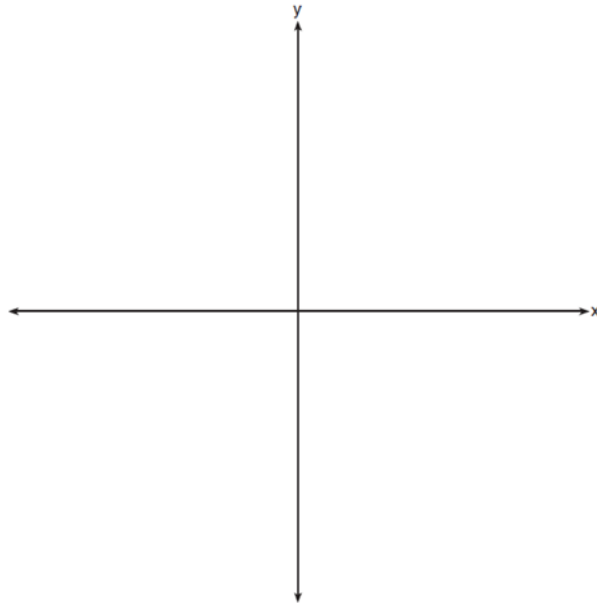
b) Explain any differences between a sketch of
$y = 2\sin\left(x - \dfrac{\pi}{3}\right) - \dfrac{3}{2}$ and the sketch from part a.

36 Using a microscope, a researcher observed and recorded the number of bacteria spores on a large sample of uniformly sized pieces of meat kept at room temperature. A summary of the data she recorded is shown in the table below.

Hours (x)	Average Number of Spores (y)
0	4
0.5	10
1	15
2	60
3	260
4	1130
6	16,380

Using these data, write an exponential regression equation, rounding all values to the *nearest thousandth*. The researcher knows that people are likely to suffer from food-borne illness if the number of spores exceeds 100. Using the exponential regression equation, determine the maximum amount of time, to the *nearest quarter hour*, that the meat can be kept at room temperature safely.

37 The value of a certain small passenger car based on its use in years is modeled by $V(t) = 28482.698(0.684)^t$, where $V(t)$ is the value in dollars and t is the time in years. Zach had to take out a loan to purchase the small passenger car. The function $Z(t) = 22151.327(0.778)^t$, where $Z(t)$ is measured in dollars, and t is the time in years, models the unpaid amount of Zach's loan over time. Graph $V(t)$ and $Z(t)$ over the interval $0 \le t \le 5$, on the set of axes below.
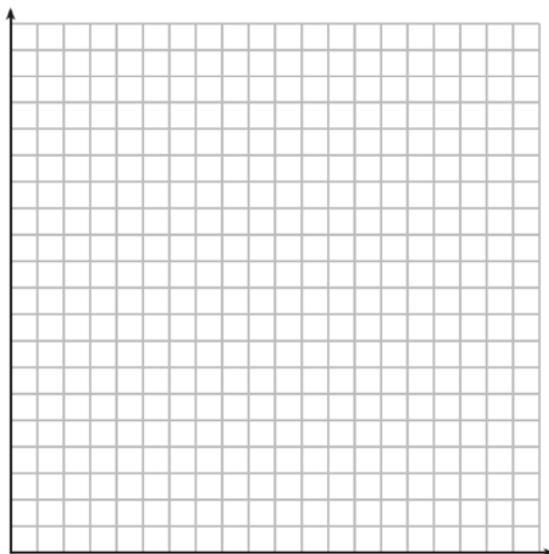
State when $V(t) = Z(t)$, to the *nearest hundredth*, and interpret its meaning in the context of the problem. Zach takes out an insurance policy that requires him to pay a $3000 deductible in case of a collision. Zach will cancel the collision policy when the value of his car equals his deductible. To the *nearest year*, how long will it take Zach to cancel this policy? Justify your answer.

0817AII Common Core State Standards
Answer Section

1 ANS: 1

$$x^2 + 2x - 8 = 0$$

$$(x + 4)(x - 2) = 0$$

$$x = -4, 2$$

PTS: 2   REF: 081701aii   NAT: A.APR.D.6   TOP: Undefined Rationals

2 ANS: 3

$$(3k - 2i)^2 = 9k^2 - 12ki + 4i^2 = 9k^2 - 12ki - 4$$

PTS: 2   REF: 081702aii   NAT: N.CN.A.2   TOP: Operations with Complex Numbers

3 ANS: 3

$$x^2 + 2x + 1 = -5 + 1$$

$$(x + 1)^2 = -4$$

$$x + 1 = \pm 2i$$

$$x = -1 \pm 2i$$

PTS: 2   REF: 081703aii   NAT: A.REI.B.4   TOP: Solving Quadratics
KEY: complex solutions | completing the square

4 ANS: 2

$$\sqrt{x + 14} = \sqrt{2x + 5} + 1 \qquad \sqrt{22 + 14} - \sqrt{2(22) + 5} = 1$$

$$x + 14 = 2x + 5 + 2\sqrt{2x + 5} + 1 \qquad\qquad 6 - 7 \neq 1$$

$$-x + 8 = 2\sqrt{2x + 5}$$

$$x^2 - 16x + 64 = 8x + 20$$

$$x^2 - 24x + 44 = 0$$

$$(x - 22)(x - 2) = 0$$

$$x = 2, 22$$

PTS: 2   REF: 081704aii   NAT: A.REI.A.2   TOP: Solving Radicals
KEY: advanced

5 ANS: 3   PTS: 2   REF: 081705aii   NAT: F.IF.B.4
TOP: Graphing Trigonometric Functions   KEY: increasing/decreasing

6 ANS: 2

The vertex of the parabola is $(0,0)$. The distance, p, between the vertex and the focus or the vertex and the directrix is 1. $y = \dfrac{-1}{4p}(x-h)^2 + k$

$$y = \dfrac{-1}{4(1)}(x-0)^2 + 0$$

$$y = -\dfrac{1}{4}x^2$$

PTS: 2　　　REF: 081706aii　　NAT: G.GPE.A.2　TOP: Graphing Quadratic Functions

7 ANS: 4　　　PTS: 2　　　REF: 081707aii　　NAT: F.TF.A.2
TOP: Reference Angles

8 ANS: 4　　　PTS: 2　　　REF: 081708aii　　NAT: A.APR.B.3
TOP: Zeros of Polynomials　　　KEY: AII

9 ANS: 3

$$\log_{0.8}\left(\dfrac{V}{17000}\right) = t \qquad\qquad \dfrac{17{,}000(0.8)^3 - 17{,}000(0.8)^1}{3-1} \approx -2450$$

$$0.8^t = \dfrac{V}{17000}$$

$$V = 17000(0.8)^t$$

PTS: 2　　　REF: 081709aii　　NAT: F.IF.B.6　　TOP: Rate of Change
KEY: AII

10 ANS: 3

$$\left(\dfrac{1}{2}\right)^{\frac{1}{73.83}} \approx 0.990656$$

PTS: 2　　　REF: 081710aii　　NAT: A.SSE.B.3　TOP: Modeling Exponential Functions
KEY: AII

11 ANS: 1

1.2	1.3 ▶ *Doc ▽	RAD ◨ X
normCdf(0,3.7,4,0.2)		0.066807

PTS: 2　　　REF: 081711aii　　NAT: S.ID.A.4　　TOP: Normal Distributions
KEY: percent

12 ANS: 4
The maximum volume of $p(x) = -(x + 2)(x - 10)(x - 14)$ is about 56, at $x = 12.1$

PTS: 2   REF: 081712aii   NAT: F.IF.B.4   TOP: Graphing Polynomial Functions

13 ANS: 1

$$
\begin{array}{r}
2x^2 + x + 5 \\
2x - 1 \overline{)\; 4x^3 + 0x^2 + 9x - 5} \\
\underline{4x^3 - 2x^2} \\
2x^2 + 9x \\
\underline{2x^2 - x} \\
10x - 5 \\
\underline{10x - 5}
\end{array}
$$

PTS: 2   REF: 081713aii   NAT: A.APR.D.6   TOP: Rational Expressions

14 ANS: 2

$$x = \frac{y + 1}{y - 2}$$

$$xy - 2x = y + 1$$

$$xy - y = 2x + 1$$

$$y(x - 1) = 2x + 1$$

$$y = \frac{2x + 1}{x - 1}$$

PTS: 2   REF: 081714aii   NAT: F.BF.B.4   TOP: Inverse of Functions
KEY: equations

15 ANS: 1
1) let $y = x + 2$, then $y^2 + 2y - 8$

$$(y + 4)(y - 2)$$

$$(x + 2 + 4)(x + 2 - 2)$$

$$(x + 6)x$$

PTS: 2   REF: 081715aii   NAT: A.SSE.A.2   TOP: Factoring Polynomials
KEY: multivariable

16 ANS: 2

$$ME = \left(z\sqrt{\frac{p(1 - p)}{n}} \right) = \left(1.96\sqrt{\frac{(0.16)(0.84)}{1334}} \right) \approx 0.02$$

PTS: 2   REF: 081716aii   NAT: S.IC.B.4   TOP: Analysis of Data

17 ANS: 2   PTS: 2   REF: 081717aii   NAT: S.IC.B.3
    TOP: Analysis of Data   KEY: type

18 ANS: 4   PTS: 2   REF: 081718aii   NAT: F.IF.C.7
    TOP: Graphing Trigonometric Functions   KEY: amplitude

19 ANS: 1

$$(x + 3)^2 + (2x - 4)^2 = 8 \qquad b^2 - 4ac$$

$$x^2 + 6x + 9 + 4x^2 - 16x + 16 = 8 \quad 100 - 4(5)(17) < 0$$

$$5x^2 - 10x + 17 = 0$$

    PTS: 2   REF: 081719aii   NAT: A.REI.C.7   TOP: Quadratic-Linear Systems
    KEY: AII

20 ANS: 2

$$\begin{array}{r|rrrr} -4 & 1 & -11 & 16 & 84 \\ & & -4 & 60 & -304 \\ \hline & 1 & -15 & 76 & \end{array}$$

Since there is a remainder when the cubic is divided by $x + 4$, this binomial is not a factor.

    PTS: 2   REF: 081720aii   NAT: A.APR.B.2   TOP: Remainder Theorem

21 ANS: 4

$$d = 32(.8)^{b-1} \quad S_n = \frac{32 - 32(.8)^{12}}{1 - .8} \approx 149$$

    PTS: 2   REF: 081721aii   NAT: A.SSE.B.4   TOP: Series

22 ANS: 1   PTS: 2   REF: 081722aii   NAT: S.IC.B.6
    TOP: Analysis of Data

23 ANS: 4

$$\left(\frac{-54x^9}{y^4}\right)^{\frac{2}{3}} = \frac{(2 \cdot -27)^{\frac{2}{3}} x^{\frac{18}{3}}}{y^{\frac{8}{3}}} = \frac{2^{\frac{2}{3}} \cdot 9x^6}{y^2 \cdot y^{\frac{2}{3}}} = \frac{9x^6 \sqrt[3]{4}}{y^2 \sqrt[3]{y^2}}$$

    PTS: 2   REF: 081723aii   NAT: N.RN.A.2   TOP: Radicals and Rational Exponents
    KEY: variables

24 ANS: 3   PTS: 2   REF: 081724aii   NAT: F.BF.A.2
    TOP: Sequences

25 ANS:

Rewrite $\frac{4}{3}$ as $\frac{1}{3} \cdot \frac{4}{1}$, using the power of a power rule.

    PTS: 2   REF: 081725aii   NAT: N.RN.A.1   TOP: Radicals and Rational Exponents

26 ANS:

$$P(W/D) = \frac{P(W^\wedge D)}{P(D)} = \frac{.4}{.5} \approx .8$$

    PTS: 2   REF: 081726aii   NAT: S.CP.B.6   TOP: Conditional Probability

27 ANS:

$$(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$$

$$x^4 + 2x^2y^2 + y^4 = x^4 - 2x^2y^2 + y^4 + 4x^2y^2$$

$$x^4 + 2x^2y^2 + y^4 = x^4 + 2x^2y^2 + y^4$$

PTS: 2   REF: 081727aii   NAT: A.APR.C.4   TOP: Polynomial Identities

28 ANS:

Since there are six flavors, each flavor can be assigned a number, 1-6. Use the simulation to see the number of times the same number is rolled 4 times in a row.

PTS: 2   REF: 081728aii   NAT: S.IC.A.2   TOP: Analysis of Data

29 ANS:

$a_1 = 4$ $a_8 = 639$

$a_n = 2a_{n-1} + 1$

PTS: 2   REF: 081729aii   NAT: F.LE.A.2   TOP: Sequences

30 ANS:

$8.75 = 1.25x^{49}$ 4

$\quad 7 = x^{49}$

$\quad x = \sqrt[49]{7} \approx 1.04$
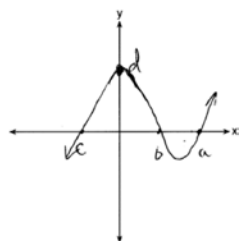
PTS: 2   REF: 081730aii   NAT: F.LE.A.4   TOP: Exponential Growth

31 ANS:

$j(-x) = (-x)^4 - 3(-x)^2 - 4 = x^4 - 3x^2 - 4$ Since $j(x) = j(-x)$, the function is even.

PTS: 2   REF: 081731aii   NAT: F.BF.B.3   TOP: Even and Odd Functions

32 ANS:

PTS: 2   REF: 081732aii   NAT: F.IF.C.7   TOP: Graphing Polynomial Functions

KEY: AII

33 ANS:

$$\frac{3p}{p-5} = \frac{p+2}{p+3}$$

$$3p^2 + 9p = p^2 - 3p - 10$$

$$2p^2 + 12p + 10 = 0$$

$$p^2 + 6p + 5 = 0$$

$$(p+5)(p+1) = 0$$

$$p = -5, -1$$

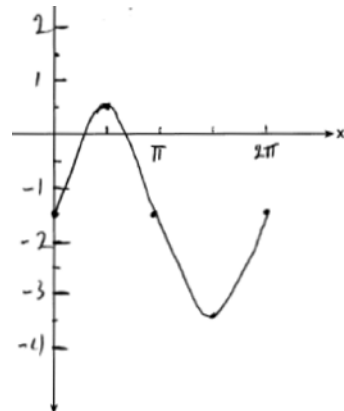PTS: 4   REF: 081733aii   NAT: A.REI.A.2   TOP: Solving Rationals
KEY: rational solutions

34 ANS:

$\frac{6.25 - 2.25}{21 - 5} = \frac{4}{16} = \$.25$ fine per day. $2.25 - 5(.25) = \$1$ replacement fee. $a_n = 1.25 + (n-1)(.25)$. $a_{60} = \$16$

PTS: 4   REF: 081734aii   NAT: F.LE.A.2   TOP: Sequences

35 ANS:

Part a sketch is shifted $\frac{\pi}{3}$ units right.

PTS: 4   REF: 081735aii   NAT: F.IF.C.7   TOP: Graphing Trigonometric Functions
KEY: graph

36 ANS:

$y = 4.168(3.981)^x$. $100 = 4.168(3.981)^x$

$$\log \frac{100}{4.168} = \log(3.981)^x$$

$$\log \frac{100}{4.168} = x \log(3.981)$$

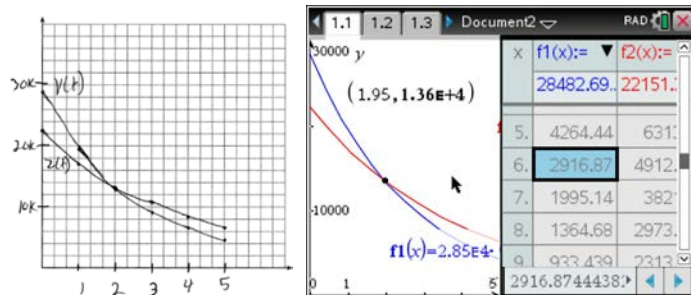$$\frac{\log \frac{100}{4.168}}{\log(3.981)} = x$$

$$x \approx 2.25$$

PTS: 4   REF: 081736aii   NAT: S.ID.B.6   TOP: Regression
KEY: exponential AII

37 ANS:

 At 1.95 years, the value of the car equals the loan balance. Zach can cancel the policy after 6 years.

PTS: 4   REF: 081737aii   NAT: A.REI.D.11   TOP: Other Systems
KEY: AII